

We are in the midst of *a great change*. It feels only fitting to begin my teaching philosophy by reflecting on the evolving roles of faculty, coursework and academia in this new reality — a reflection that has led me to affirm, with clarity and conviction, that this is where I belong.

### Redefining the Educator's role in an AI-Driven World

In today's world where knowledge is abundantly accessible, personalized, and conversational, my role as an educator is not merely to transmit facts but to cultivate curiosity, discernment, and intellectual independence. I strive to move students towards the “why?” and “how?” of learning — so that it feels rewarding and becomes meaningful, not obligatory. As AI tools become indispensable, I want my students to develop a healthy skepticism toward AI's responses by staying grounded in the basics. For example, I recently explored differential geometry through dialogue with AI, but only because my calculus foundation allowed me to validate and refine responses. This interplay — using AI as a collaborator while remaining anchored in first principles — is the essential skillset I aim to instill, ensuring students become critical thinkers and avid creators of the new age.

### Reimagining Engineering Education for the 21<sup>st</sup> century

In the U.S., degrees awarded in computing disciplines have grown by nearly 20% year-over-year, while traditional fields like electrical and mechanical engineering show slower growth or even declines.<sup>1</sup> Yet as academics, we recognize the enduring value of physics and mathematics—even in the age of AI. This moment calls for reimagining engineering coursework: imagine teaching the Fourier Transform, an indispensable tool in signal processing, through the lens of Transformer architectures (think GPT models). Or exploring Heat Diffusion, a cornerstone of thermodynamics, in the context of modern Diffusion models driving generative AI. This approach balances catering to the interests of young minds while steering them toward strengthening their fundamentals to weather any paradigm shifts.

### Reasserting Academia's Purpose in the Age of Intelligent Systems

Just as every major technological wave — railroads, electricity, the internet — transitioned from a scientific phase to an industrial phase, AI has entered its own industrial era. Today, incentives favor writing thin wrappers around foundation models rather than confronting deep, paradigm-shifting questions such as how reality itself emerges from the laws of physics. But academia faces a dual mandate: supplying the workforce market while nurturing the creation of knowledge. I believe the path forward is to educate market-makers about the intangible benefits of a young workforce exposed to diverse ideas. These are the individuals who can grow into leaders shaping their future industries, rather than be placeholders destined to be replaced by automation. Because if we reduce education to short-term job training, what happens when the jobs themselves disappear?

### Mentorship Experience and Philosophy

As a graduate student and postdoctoral fellow, I have gained valuable experience advising diverse students in their research pursuits, guiding them through technical challenges while fostering intellectual independence. Now, as I step into the role of leading *MARVILS*, my future research lab, as a PI, my goal is to nurture my students into future visionary leaders. I envision my lab as a dynamic hub for the incubation of ideas and experiences, where students enter with passion and curiosity and emerge with clarity, confidence and purpose. My own journey has been shaped by such environments under my Ph.D. and postdoctoral advisors, whose mentorship profoundly influenced my worldview and reinforced my belief in the transformative power of guidance.

In today's often chaotic world — driven by citation counts and external validation — I have, at times, buckled under peer-pressure and wrestled with self-doubt. In those moments, I found solace in a simple truth: my advisors chose me because they saw something unique in me. To my future students, I see it as my responsibility to be that anchor — a steady buoy when the waters get rough. As a PI, I will use my vantage point to guide them toward deep, meaningful questions that cannot be easily scooped, giving them the time and space to build true expertise and a sense of ownership over their work.

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<sup>1</sup>[datausa.io](https://datausa.io) - CS, [datausa.io](https://datausa.io) - EE, [datausa.io](https://datausa.io) - ME

As we reassert academia's purpose as the *de facto* place for those who dare to look beyond the horizon, I want my physical lab space to embody that vision (see end of my research statement for a render). Three of the four walls will be dedicated to researchers working on Theory, Measurements, and Inference, respectively. The fourth wall will be reserved for whiteboards, projectors, and collaborative displays to foster discussion and synthesis. I want my students to *feel* how their work fits into the bigger picture. I am committed to bringing in students from across the scientific spectrum — through co-advisement and interdisciplinary programs — because when AI can code and compute, it is time we look back to the sciences. My goal is for students to mutually benefit from diverse ideas and perspectives so they can not only contribute to the future but *start it up*.

### Teaching Philosophy and Reflection

As a student, I often felt disconnected from course materials taught in traditional settings. Even though I was fortunate to attend India's premier institute for my undergraduate studies, I spent more sleepless nights building makeshift robots at the student-led Center for Innovation than attending lectures or completing assignments. Ironically, the signals and systems course — where I scored my lowest grade — would later become the backbone of the research papers I am most proud of.

My experience is not unique. There is growing concern that students question the value of traditional curricula.<sup>2 3</sup> As a student, I didn't appreciate the importance of signals and systems, but my professor likely did. Bridging this divide is the essence of my teaching philosophy.

If I were to teach the same course tomorrow, I would begin by asking students to share their career ambitions when enrolling. Using AI, I would generate a personalized pitch showing how the course content aligns with their goals — or suggest alternative courses if it doesn't. I would also leverage AI to customize examples and case studies in the course materials to reflect the class's diverse aspirations. While vetting these materials may require extra effort initially, I expect the cost to amortize over time. Most importantly, this AI-mediated experience would give both my students and myself the clarity and a sense of purpose for productively engaging in the course.

### Teaching Interests

My interdisciplinary background — spanning Electrical Engineering, Robotics, and Physics-based Computer Vision — positions me to teach a wide range of courses at both undergraduate and graduate levels. Given my commitment to reimagining engineering education, I am eager to contribute to college-wide initiatives that develop innovative coursework. Within traditional engineering curricula, I am prepared to teach introductory courses in computer vision, AI, linear algebra, and signals and systems.

Beyond standard offerings, I am designing two new interdisciplinary courses that bridge sensing and reasoning. First is a graduate-level seminar course, called Scientific Computational Imaging (SCI), that compiles knowledge across disciplines unified by physics yet separated by disciplinary silos. Second is a graduate-level, hands-on laboratory, called Sensor AI Lab, that harnesses student creativity to invent new ways to “see” our world. Details will be available at <https://marvils.org/courses> as I build them out. Both offerings advance our long-term mission of developing *ViBE: Vision-By-Energetics*, a framework that unifies perception through physics and energetics.

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<sup>2</sup>2024 Pew trends report: Trends and predictions that are defining stem in 2024, February 2024

<sup>3</sup>Fry, D. Braga, and K. Parker. Is college worth it? americans hold mixed views on the value of a four-year degree, May 2024